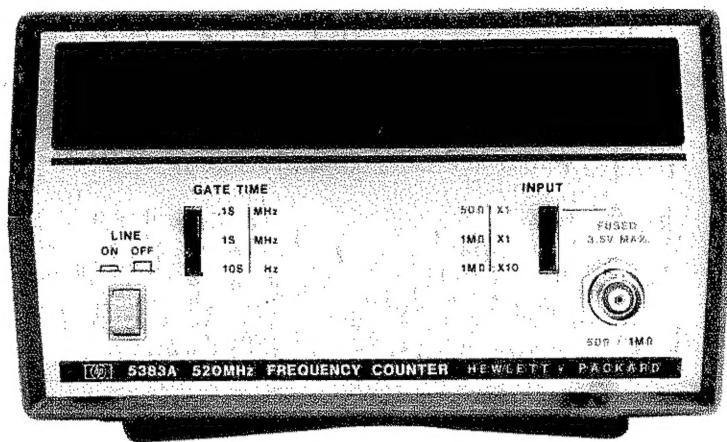


# FREQUENCY COUNTER

## 5383A



HEWLETT  PACKARD



# FREQUENCY COUNTER

## 5383A

# OPERATING MANUAL

SERIAL PREFIX: 1628A

This manual applies directly to HP Model 5383A Frequency Counters having serial number prefix 1628A.

## NEWER INSTRUMENTS

This manual, with enclosed "Manual Changes" sheet, applies to HP Model 5383A Frequency Counters having serial number prefixes as listed on the "Manual Changes" sheet.

## OLDER INSTRUMENTS

For serial prefixes below the serial prefix shown above, refer to Section VII for manual backdating instructions.

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**MANUAL PART NUMBER 05383-90005**  
**Microfiche Part Number 05383-90006**

Printed: SEP 1976

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## SECTION I GENERAL INFORMATION

### 1-1. INTRODUCTION

1-2. This section of the manual gives a description of the instrument, information on instrument identification and available options, and complete specifications.

### 1-3. INSTRUMENT DESCRIPTION

1-4. The HP Model 5383A (see Figure 1-1) is a direct-counting frequency counter that has a range of 10 Hz to 520 MHz. Nine display digits provide a resolution of one Hz per second for inputs up to 520 MHz. Front panel controls allow a selection of gate times, input impedances, and attenuators. A rear panel connector and associated selector switch allow either an external time base oscillator input, or monitoring of the internal time base oscillator. When the optional temperature compensated crystal oscillator (TCXO) is installed, the rear panel connector serves only as a time base monitor. In addition, a rear panel power selector switch permits the 5383A Counter to operate with line voltages ranging from 90V to 252V (line frequency range: 48 to 440 Hz).

### 1-5. ACCESSORIES AND OPTIONS

1-6. Two accessories are available for mounting the 5383A counter onto the user's rack. The 10851A kit permits the mounting of a single counter, while the 10852A kit is used for mounting two counters in a side-by-side configuration. Refer to Section II for detailed rack mounting kit information.

1-7. Option 001 provides a more accurate and stable time base oscillator. This Temperature Compensated Crystal Oscillator (TCXO) installation modifies the rear panel so that the connector is used only as a MONITOR output. As a result, an external standard (i.e., time base) cannot be applied to the Option 001 counter.

### 1-8. INSTRUMENT IDENTIFICATION

1-9. Hewlett-Packard uses a 2-section, 10-character serial number (0000A00000) mounted on the rear panel to identify the instrument. The first four digits are the serial prefix and the last five digits refer to the specific instrument. The alphabetical character identifies the country of manufacture. If the serial prefix on your instrument differs from that listed on the title page of this manual, there are differences between the manual and your instrument. Any lower serial prefixes are documented separately in this manual, and higher serial prefixes are covered by a manual change sheet included with the manual.

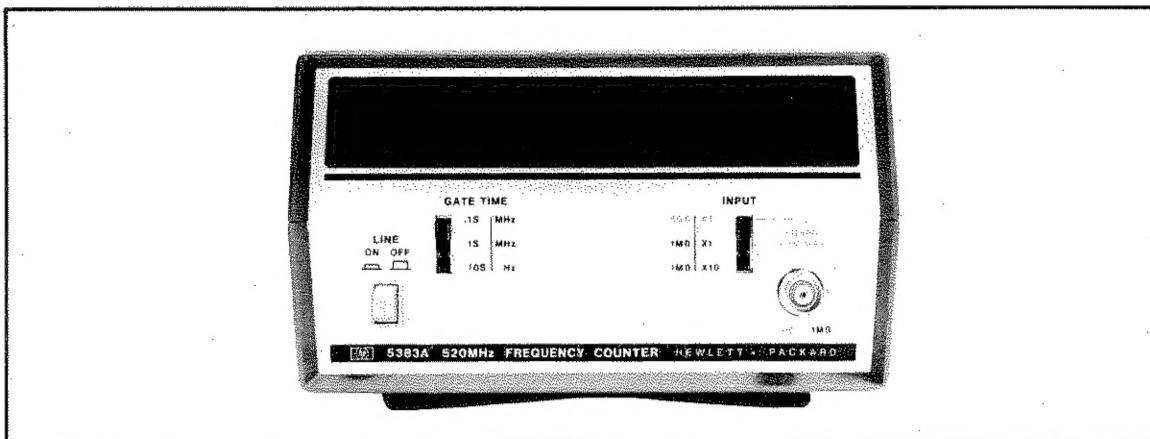


Figure 1-1. Model 5383A Frequency Counter



1-10. The printed circuit boards within the instrument are identified by a 2-section, 10-digit part number (e.g., 05383-60001) and a 4-digit series number (e.g., "SERIES 1508"). The series number identifies the electrical characteristics of the complete printed-circuit assembly. A replacement circuit-board assembly may have a different series number than the assembly originally supplied with the instrument. Therefore, when troubleshooting a circuit-board assembly, ensure that the series number on the schematic diagram matches the series number on the board assembly. If the series number of the assembly is lower than the number on the schematic diagram in Section VIII, refer to backdating information in this manual for change information. If the series number on the assembly is higher than the number on the schematic diagram, the change information is provided in a manual change sheet which is available from the nearest Hewlett-Packard Sales and Service Office.

#### 1-11. MICROFICHE NUMBER

1-12. On the title page of this manual, below the manual part number, is the microfiche part number. This number may be used to order 4 x 6 transparencies of the manual. The microfiche package also includes the latest Manual Change Supplements as well as all pertinent Service Notes.

#### 1-13. RECOMMENDED TEST EQUIPMENT

1-14. Table 1-1 lists test equipment which is recommended for confirming instrument specifications (i.e., in-cabinet performance tests), as well as troubleshooting and adjusting the instrument.

Table 1-1. Recommended Test Equipment.

Equipment Type	Required Characteristics	Suggested Model	Use*
Oscilloscope	50 MHz Bandwidth	HP 180A System	A,T
Test Oscillator	10 Hz to 10 MHz 25 mV Output	HP 651B	P,T
Signal Generator	10 MHz to 520 MHz 25 mV Output	HP 8654A	P,T
DVM	0—25V Range	HP 970A	T
Frequency Counter	High stability 10 MHz frequency standard	HP 5328A with Option 10 or HP 5345A	A,P
50 Ohm Feedthru Connector	50 Ohm Termination	HP 11048C	P,T

\*A = Adjustments, P = Performance Test, T = Troubleshooting

#### 1-15. SPECIFICATIONS

1-16. Table 1-2 lists the 5383A specifications.



Table 1-2. Specifications

**FREQUENCY RANGE:** 10 Hz to 520 MHz

**DISPLAY:** Nine-segment LED digits

**DISPLAY TEST:** RESET function (activated with GATE TIME switch) illuminates all segments of all digits.

**INPUT IMPEDANCE:** Three selections:

50Ω X1 (nominal) — fuse protected

1MΩ X1 (<40 pF shunt)

1MΩ X10 (<40 pF shunt, attenuation factor of 10)

**ATTENUATION:** X10 in 1MΩ

**SENSITIVITY:**

INPUT Switch Position	Frequency Range	Sensitivity (RMS)
50Ω X1	20 Hz to 520 MHz	25 mV
1MΩ X1	20 Hz to 10 MHz	25 mV
	10 Hz to 50 MHz	50 mV

**MAXIMUM INPUT:**

INPUT Switch Position	Range	Maximum Input
50Ω X1 (Fuse protected)	DC to 520 MHz	3.5V rms (+24 dBm)
	DC to 40 MHz	200V (sum of dc + peak ac)
	40 Hz to 100 kHz	200V dc + 250V rms (ac)
	100 kHz to 5 MHz	200V dc = $\frac{2.5 \times 10^7 \text{V rms (ac)}}{\text{Freq. (in Hz)}}$
1MΩ X1	5 MHz to 520 MHz	200V dc + 5V rms (ac)
	DC to 40 Hz	200V (sum of dc + peak ac)
	40 Hz to 1 MHz	200V dc + 250V rms (ac)
	1 MHz to 50 MHz	200V dc + $\frac{2.5 \times 10^8 \text{V rms (ac)}}{\text{Freq. (in Hz)}}$
1MΩ X10	50 MHz to 520 MHz	200V dc + 5V rms (ac)
	DC to 40 Hz	200V (sum of dc + peak ac)
	40 Hz to 1 MHz	200V dc + 250V rms (ac)
	1 MHz to 50 MHz	200V dc + $\frac{2.5 \times 10^8 \text{V rms (ac)}}{\text{Freq. (in Hz)}}$

**ACCURACY:**  $\pm 1$  Count  $\pm$  Time Base Accuracy

**GATE TIME:** Manually selected .1 second, 1 second, 10 seconds

**RESOLUTION:** (Direct Count)

GATE TIME	Least-Significant Digit Value
.1s/MHz	10 Hz
1s/MHz	1.0 Hz
10s/Hz	0.1 Hz

**OVERFLOW:** LED indicator lamp shows display overflow.

**RESET:** Manual reset occurs when GATE TIME switch is between three normal positions.

\*For example: The maximum signal level (when 1MΩ X1 input impedance is selected) for a 100 kHz input is:

$$\frac{2.5 \times 10^7}{100 \times 10^3} = 250\text{V (rms)} + 200\text{V dc}$$



Table 1-2. Specifications (Continued)

**STANDARD**

**TIME BASE DATA:**

**Time Base:** 10 MHz (Xtal Oscillator)

<3 ppm per month due to aging

±2.5 ppm due to temperature variations between 0°C and 40°C

±0.5 ppm due to ±10% line (power) variation

**Time Base Output:** Frequency: 10 MHz Time Base

Voltage: 200 mV peak-to-peak into 50Ω

Control: Active when the INT/EXT switch is in INT position.

**External Frequency Standard Input (rear panel):** 10 MHz

**Rear Panel Input:** Sensitivity: 250 mV rms

Impedance: >500Ω

Maximum Input: 10V rms

Control: Internal/External rear-panel switch at EXT.

**Ratio:** Rear Panel Input, 100 kHz to 10 MHz

**OPERATING TEMPERATURE:** 0°C to 40°C

**POWER REQUIREMENTS:** 100, 120, 220, and 240V rms +5 -10%; 48 Hz to 440 Hz; 30VA max.

**WEIGHT:** Net: 2.2 kg (4.75 lbs). Shipping: 2.7 kg (6 lbs).

**DIMENSIONS:** 89 mm H x 160 mm W x 248 mm D (3.5 in H x 6.25 in W x 9.75 in D).

**OPTION 001 TEMPERATURE COMPENSATED XTAL OSCILLATOR**

Does not provide rear panel input capability.

**TIME BASE DATA:**

**Frequency:** 10 MHz TCXO

**Stability:** <0.1 ppm per month due to aging

±1 ppm due to temperature variations between 0°C and 40°C

±0.1 ppm due to 10% line (power) variation

**Rear Panel Input:** Not available with Option 001.



## SECTION II INSTALLATION

### 2-1. INTRODUCTION

2-2. This section of the manual provides information about unpacking, inspecting, storing, and shipping the frequency counter.

### 2-3. UNPACKING AND INSPECTION

2-4. If the shipping carton is damaged, ask that the carrier's agent be present when the instrument is unpacked. Inspect the instrument for damage such as scratches, dents, broken switches, etc. If the instrument is damaged or fails to meet performance tests, notify the carrier and the nearest Hewlett-Packard Sales and Service Office immediately. Performance check procedures are located in Section V, and Sales and Service Offices are listed at the back of this manual. Retain the shipping carton and the padding material for the carrier's inspection. The Sales and Service Office will arrange for the repair or replacement of the instrument without waiting for the claim against the carrier to be settled.

### 2-5. STORAGE AND SHIPMENT

2-6. **PACKAGING.** To protect valuable electronic equipment during storage or shipment, always use the best packaging methods available. Your Hewlett-Packard Sales and Service Office can provide packaging material such as that used for original factory packaging. Contract packaging companies in many cities can provide dependable custom packaging on short notice.

2-7. **ENVIRONMENT.** Conditions during storage and shipment should normally be limited as follows:

- a. Maximum altitude: 25,000 ft.
- b. Minimum temperature: -40°F (-40°C).
- c. Maximum temperature: +167°F (+75°C).

### 2-8. LINE VOLTAGE SELECTION

2-9. The counter is supplied from the factory with the LINE VOLTAGE SELECTOR switches set for 120-volt. If any other supply voltage is to be used, change the rear-panel switch settings as follows:

- a. Using a small screwdriver, a pencil, or other suitable tool, set the LINE VOLTAGE SELECTOR switches on the counter's rear panel to the positions shown next to the desired voltage marking on the rear panel.
- b. Ensure that the correct fuse is installed. Use a Listed, 0.500 ampere, slow-blow fuse for 100-volt or 120-volt operation. Use a Listed, 0.150 ampere, slow-blow for 220-volt or 240-volt operation.



2-10. If the counter is to be used in the USA with a 240-volt, 60 Hz power source, use a power cord with a Listed connector of the type shown in Figure 2-1.

## 2-11. MOUNTING

2-12. The 5383A Frequency Counter is built to be portable, and may be used at any test bench position. Two kits are available for the user who desires to mount his counter on a rack. Kit 10851A permits one counter to be mounted in the center of a rack, while Kit 10852A allows the user to mount two counters, side-by-side on a rack. Figure 2-2 describes how to mount the counter onto the rack provided. Figure 2-3 shows these kits and provides a component parts list.

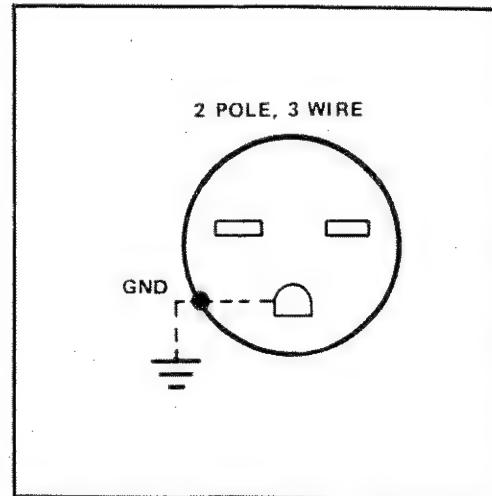


Figure 2-1. Power Cord Connector  
for 240-Volt Operation

1. REMOVE BOTH PLASTIC FEET FROM INSTRUMENT.
2. LOOSELY INSTALL STANOFFS BETWEEN SCREW HOLES IN BRACKET.
3. PUSH INSTRUMENT THRU PROFILED CUTOUT IN BRACKET.
4. TIGHTEN CLAMPING SCREWS.

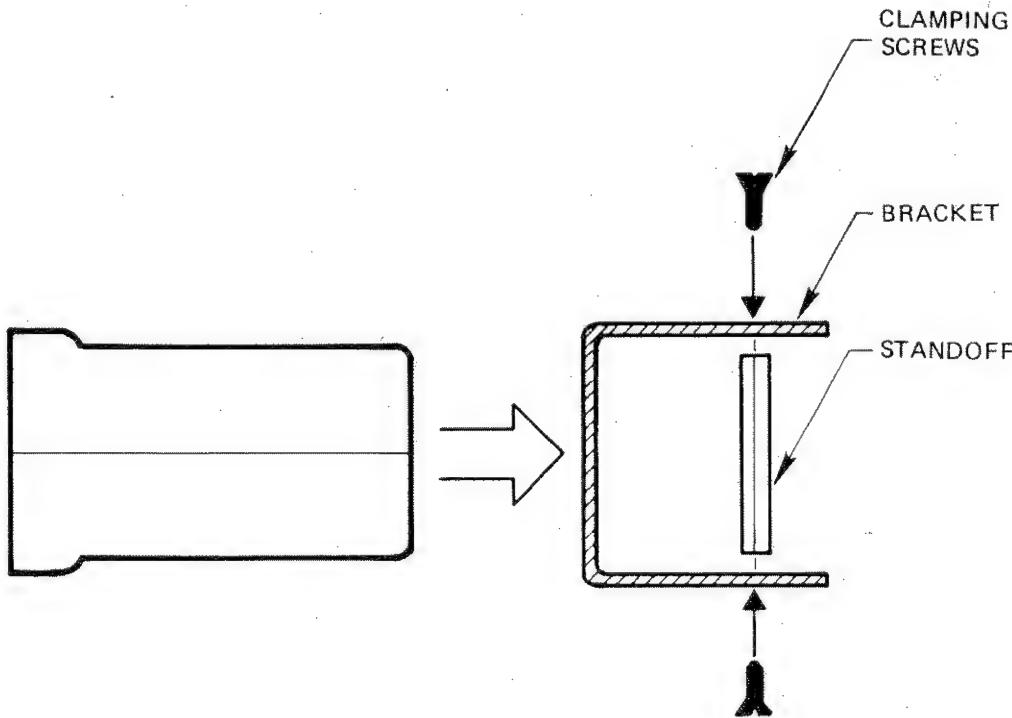


Figure 2-2. Rack Mounting Instructions



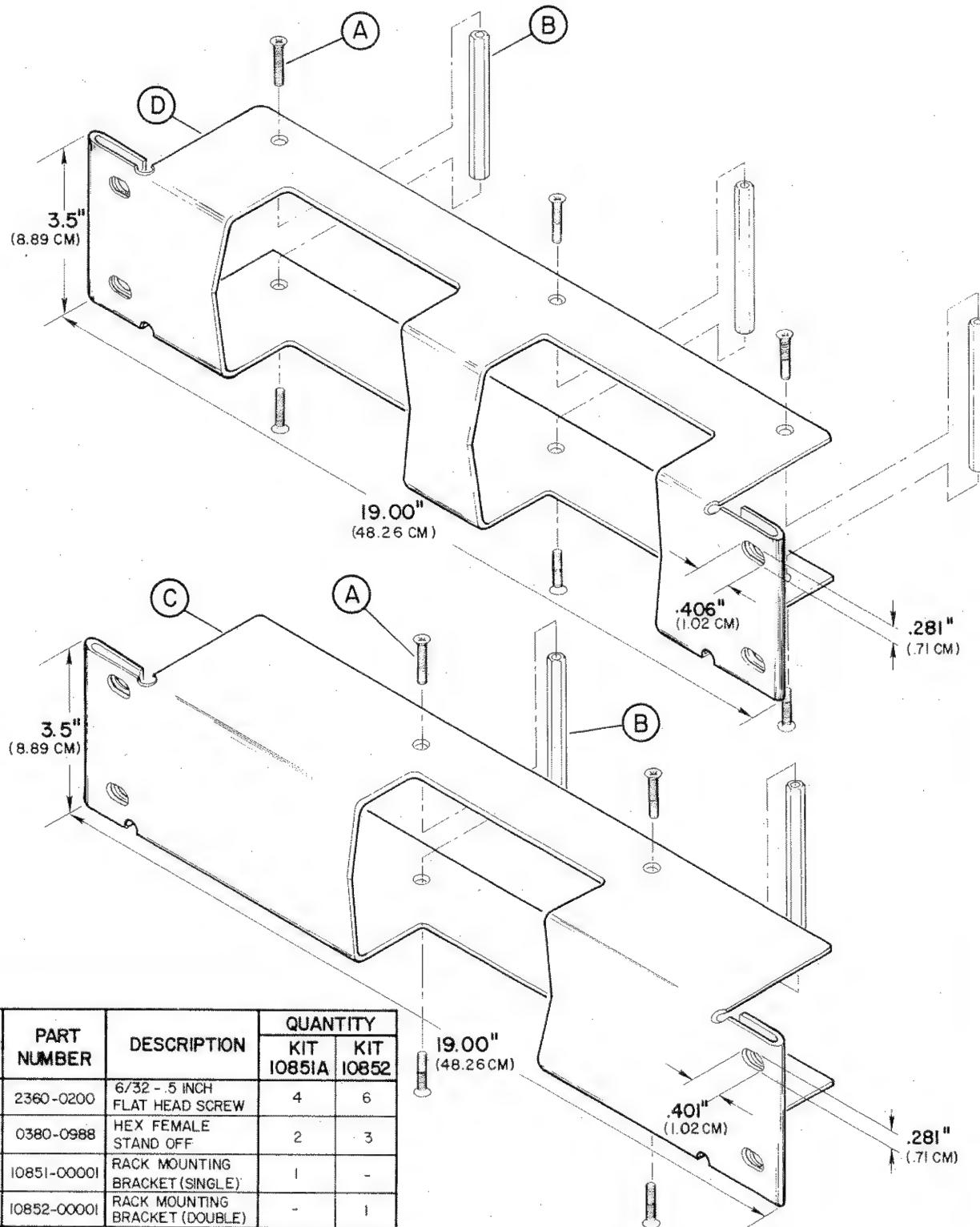


Figure 2-3. Rack Mounting Kit



## SECTION III

### OPERATION

#### 3-1. INTRODUCTION

3-2. This section contains descriptions of the controls, connectors and indicators, measurement techniques, and operator checks.

#### 3-3. CONTROLS, CONNECTORS AND INDICATORS

3-4. Figures 3-1 and 3-2 describe the operation of the 5383A controls and the function of the various connectors and indicators. The following paragraphs also provide operating guidelines and brief operator maintenance procedures for the frequency counter.

#### 3-5. MEASUREMENT TECHNIQUES

3-6. Noise riding on the input signal can cause erroneous or unstable frequency measurements. Using the internal X10 attenuator, or external attenuators minimizes this problem. Proper selection of the input impedance also allows for stable and accurate frequency measurements. When there is a difference between the signal source impedance and the counter input impedance, ringing may appear on the signal. This ringing could interfere with, and degrade the capability of the counter. Knowledge of the signal source circuit characteristics and selection of compatible 5383A input impedances and attenuation permits proper measurements. Table 3-1 (page 3-2) provides some suggested measurement techniques to help the user obtain maximum use of the frequency counter.

#### 3-7. Ratio Measurements (Standard Counter Only)

3-8. The standard counter will measure the ratio between the frequencies of two signals if one of the signals is applied to the rear-panel OSCILLATOR-EXT IN connector and the other signal is applied to the front-panel INPUT connector. (The Option 001 counter does not have an external oscillator input connector.) Be sure to refer to Table 1-2 for signal level and frequency limits. The displayed value is in units which represent the ratio of one frequency to the other as shown by the following formula:

$$\frac{\text{frequency at front panel INPUT}}{\text{freq at rear panel OSCILLATOR -EXT IN}} = \frac{\text{Display Value}}{X}$$

$$\text{where } X = \begin{cases} 10 & \text{if GATE TIME is .1s} \\ 10 & \text{if GATE TIME is 1s} \\ 10^7 & \text{if GATE TIME is 10s} \end{cases}$$

3-9. Note that in the above formula the term "X" changes by a factor of  $10^7$  when a 10s GATE TIME is set. The GATE TIME is the same when 1s and .1s selections are made. Note, also, that actual measurement time increases as the frequency applied to the OSCILLATOR-EXT IN connector decreases. If the frequency applied to the OSCILLATOR-EXT IN connector is 1 MHz, for example, and GATE TIME is set to 1s, actual measurement time will be 10 seconds.



Table 3-1. Measurement Techniques

Signal Source	Recommended Connection	Recommended 5383A Impedance/Attenuator Selection
1. Signal Generators, or circuits with output:  a. Frequency range from 10 MHz to 520 MHz b. Level less than 3.5V (rms) or +24 dBm c. Impedance of 50Ω	Via Coaxial cable or 50 ohm oscilloscope probe system (e.g., HP 10020A or equivalent)	50Ω X1
2. Signal Generators, or circuits with output:  a. Frequency range from 10 MHz to 520 MHz b. Level exceeding 3.5V (rms) or more than +24 dBm c. Impedance of 50Ω	Via external 50 ohm coaxial attenuator and coaxial cable	50Ω X1
3. Signal Generators, circuits with output frequency less than 50 MHz, or high voltage circuits	Via appropriately terminated coaxial cable, 1 MΩ oscilloscope probe (e.g., HP 10004D or equivalent)	1MΩ X1 1MΩ X10
4. 10 Hz to 100 kHz signals with high frequency noise components	Via coaxial cable or oscilloscope probes	1MΩ X1, or 1MΩ X10 with internal 100 kHz low pass filter selected (see Figure 3-1, item 6)
5. Transmitter or other high voltage oscillator circuits	DO NOT CONNECT DIRECTLY TO COUNTER INPUT! Use a pick-up antenna and proper attenuators. NOT THE TRANSMITTER ANTENNA!	50Ω X1
6. High frequency, high power, high impedance circuits	DO NOT CONNECT DIRECTLY TO COUNTER INPUT! Use an inductive loop pick-up device and appropriate attenuators	50Ω X1
7. High frequency, high impedance low power output	Active probe system (e.g., HP 1120A or equivalent) NOTE: A probe power supply (e.g., HP 1122A or equivalent) is required, passive attenuator probes	50Ω X1
8. High frequency signals with a dc level other than zero volts	Coaxial cable with dc blocking capacitor (e.g., HP 10240B or equivalent)	50Ω X1



### 3-10. OPERATOR CHECKS

3-11. These quick preliminary checks should be performed by the operator when an instrument failure is suspected:

Problem I. No display digits are illuminated

#### CHECK

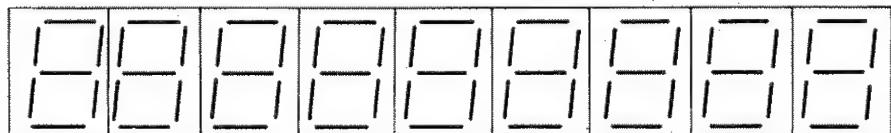
- Equipment cable plugged in?
- Proper line voltage selected on rear panel? (Refer to Paragraph 2-8.)
- Rear panel fuse blown? Replace blow fuse with a Listed,  $\frac{1}{2}$  Amp slow-blow 125-volt fuse (HP Part Number 2110-0008) for 100-120 volt operation or a Listed,  $\frac{1}{4}$  Amp (HP Part Number 2110-0201) slow-blow 250-volt fuse for 220-240 volt operation.

Problem II. All display digits are not illuminated.

- This is normal. The counter provides a leading zero blanking feature which blanks non-significant display digits. The following displays are correct when a signal is not applied to the counter input:

GATE TIME Switch Position	DISPLAY
.1 S/MHz	
1 S/MHz	
10 S/Hz	

- For further assurance, set the GATE TIME switch between any two positions. The following display indicates that all display digit circuits are operating correctly:



#### NOTE

When positioned for the display digits test function, GATE TIME switch A1S2 may or may not open the ground lead to the decimal point input of the display LED. For this reason the decimal point may or may not be illuminated during this digit test.



Problem III. The frequency counter is not counting the input signal.

CHECK:-

- a. Is the rear panel INT/EXT switch in the INT position? (This switch exists in the standard counter only.)
- b. Does this problem occur only when the front panel INPUT switch is in the  $50\Omega$  X1 or  $1M\Omega$  X1 position? This indicates that the internal fuse, A1F1, is blown. Remove instrument covers to gain access to this fuse (refer to Paragraph 5-17, note WARNING). Replace fuse with spare provided on the Main Board Assembly. Order another .1 amp 125-volt fuse (HP Part Number 2110-0436).

**NOTE**

REMEMBER TO KEEP THE INPUT SIGNAL LEVEL BELOW 3.5V (RMS) OR +24 DBM WHEN THE INPUT SWITCH IS IN THE  $50\Omega$  X1!

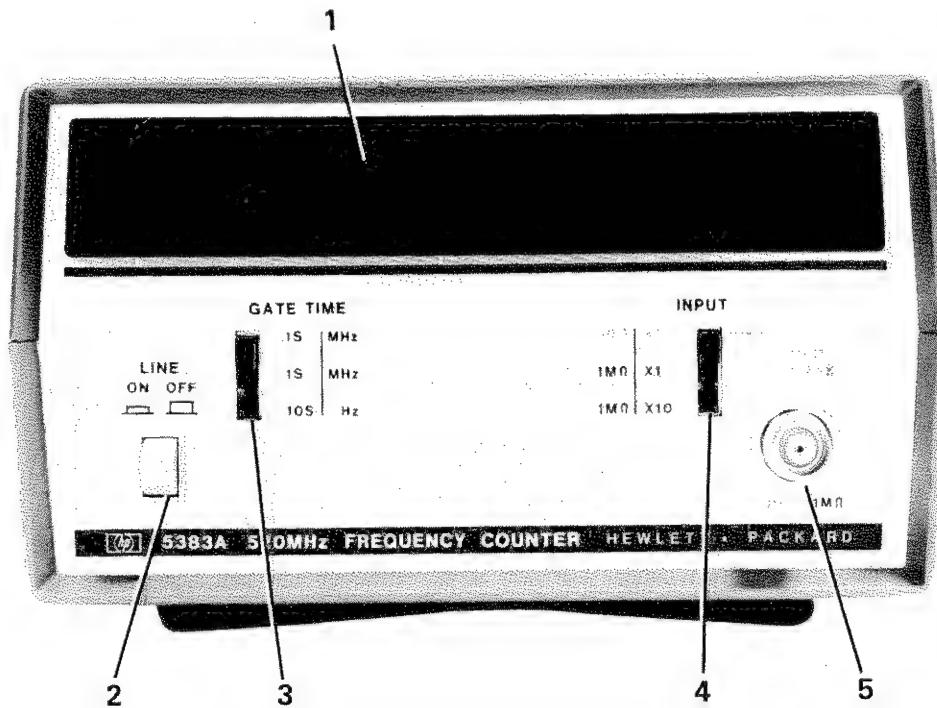
- c. Does this problem occur only when the INPUT switch is in the  $1M\Omega$  X1 or X10 positions and the input frequency goes higher than 100 kHz? Remove the covers (refer to Paragraph 5-17, note the WARNING). Set the board-mounted FILTER switch to the left (i.e., away from the ">").

3-12. Finally, this quick and convenient loop-around check is provided to verify normal operation of the instrument:

- a. Set the rear panel INT/EXT switch (exists on the standard counter only) to the INT position.
- b. Set the front panel INPUT switch to the  $50\Omega$  X1 position.
- c. Connect a coaxial cable between the rear panel OSCILLATOR jack and the front panel INPUT jack.
- d. 10 MHz display ( $\pm 1$  least-significant digit) indicates that the counter is operating normally.
- e. For loop-around check of the  $1M\Omega$  X1, or X10 INPUT paths, use a  $50\Omega$  Feedthru connector (see Table 5-1, test 2 items e, f, g.).

3-13. If, after these operator checks are performed, the counter does not operate normally, refer to the Troubleshooting Charts: Figure 5-1 and 5-2 in Section V for fault analysis procedures.





**1. DISPLAY:**

- a. Nine LED (light emitting diode) display digits are provided.
- b. A decimal point indicates display resolution for each GATE TIME selection.
- c. An overflow indicator (dot at the upper left position) shows when the input frequency has exceeded the counting capability of the instrument.
- d. Leading zero blanking suppresses display of non-significant digits (refer to Paragraph 3-11).

**2. LINE switch:** The ac power LINE switch is a push ON, push OFF type. When ON, the pushbutton is set further into the front panel.

**3. GATE TIME switch:**

- a. Measurement Time selects one of the following measurement times and display resolutions:

GATE TIME Switch Position	Measurement Time	The Decimal Point is Positioned so that Display Reads IN:
.1 S/MHz	1/10 second	MHz
1 S/MHz	1 second	MHz
10 S/Hz	10 seconds	Hz

Figure 3-1. Front Panel and Internal Controls, Indicators and Connectors



- b. When this switch position is changed, the frequency counting circuits are automatically reset to zero count. The new frequency count is then displayed after a delay which is determined by the GATE TIME position (i.e., the measurement time).
- c. Digit self-test provides a display digit self-test capability. When this switch is set between two GATE TIME positions, all display digits should show "8" (see NOTE in Paragraph 3-11).

4. **INPUT switch:** Selects one of the following input impedances and attenuations:

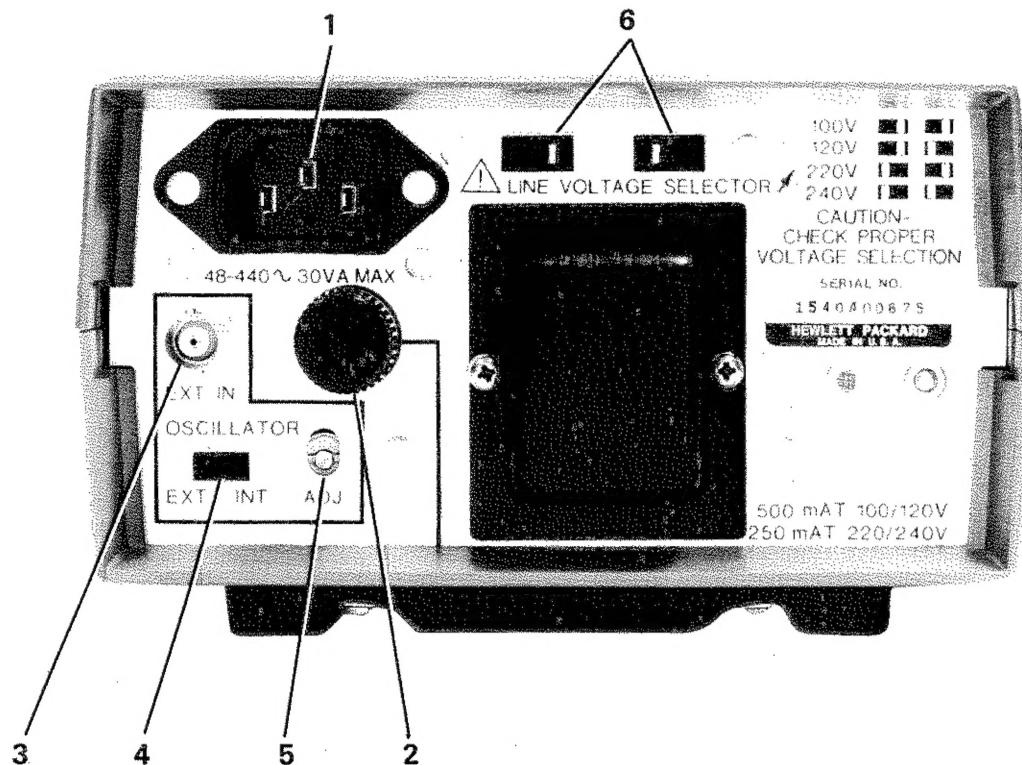
- 50 $\Omega$  X1 This input is protected from input signals that exceed 3.5V rms (+24 dBm) by an internal 0.1 amp fuse (refer to Paragraph 3-11).
- 1M $\Omega$  X1 Shunt capacity: less than 40 pf.
- 1M $\Omega$  X10 Shunt capacity: less than 40 pf.

5. **INPUT connector:** Connects signal to be measured to internal circuits. Impedance and attenuation at this jack is selected by INPUT switch.

6. **INTERNAL FILTER switch (not shown, see Figure 8-1):** This switch is positioned in the direction of the arrow (">") to select a 100 kHz low pass filter. This filter permits stable frequency measurements in the 10 Hz to 100 kHz range when the input contains higher frequency noise.

Figure 3-1. Front Panel and Internal Controls, Indicators and Connectors (Continued)





#### STANDARD REAR PANEL

- 1. POWER connector:** Connect the source of ac power to the rear-panel power connector.
- 2. FUSE:** A Listed, 0.500 ampere, slow-blow fuse is required for 100-volt or 120-volt operation; a Listed, 0.250 ampere, slow-blow fuse is required for 220-volt or 240-volt operation.
- 3. OSCILLATOR connector:** Serves as a monitoring point for the internal time base oscillator, or provides an input path for an external time base oscillator, depending on the EXT/INT switch setting.

#### NOTE

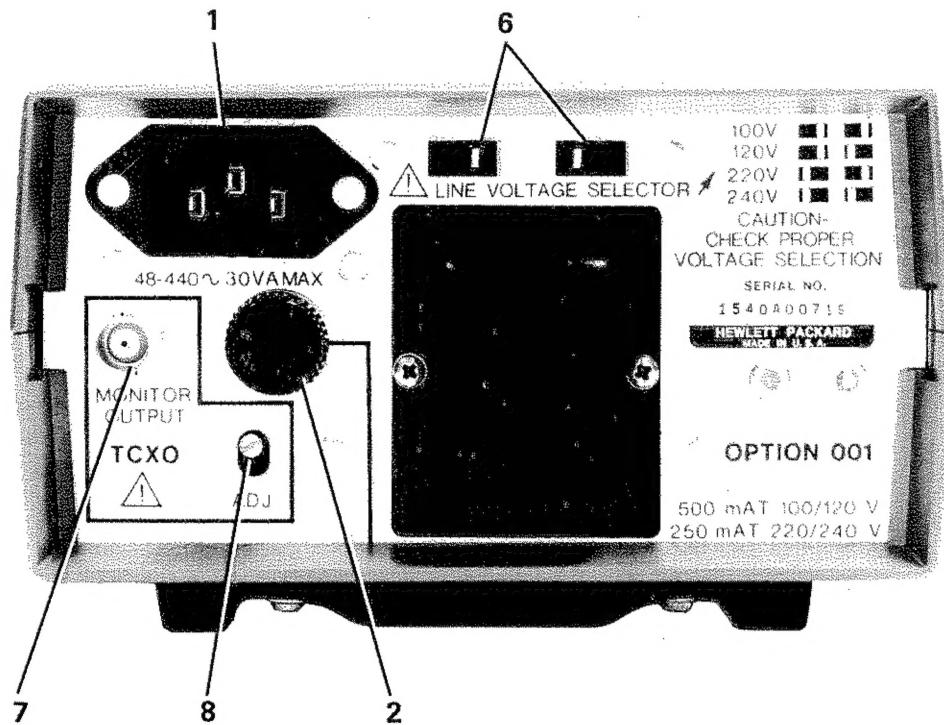
- The monitor output is designed to drive a  $50\Omega$  load.
- The internal time base oscillator output may be connected to the front panel input jack (with INPUT switch in the  $50\Omega$  X1 position) to provide a convenient counter self-check operation.

- 4. EXT/INT switch:** Selects the function of the OSCILLATOR connector:

Switch Position	OSCILLATOR Connector Function
EXT	Provides a nominal $50\Omega$ input impedance path for an external 10 MHz time base or ratio input.
INT	Monitors the internal timebase oscillator. An optimum signal is obtained when the output drives a $50\Omega$ load (>200 mV peak-to-peak).

Figure 3-2a. Rear Panel Operating Controls and Indicators





OPTION 001 REAR PANEL

5. **OSCILLATOR-ADJ control:** The ADJ control is used to set the frequency of the internal time base oscillator. Refer to the Adjustment Paragraphs 5-10 or 5-13, in Section V for information.
6. **LINE VOLTAGE SELECTOR switches:** Set the switches to correspond with the voltage of the ac power source. (Refer to Paragraph 2-8 for instructions.)
7. **MONITOR OUTPUT connector:** Serves as an internal time base oscillator monitor output connector only (see NOTE under item 3) for Option 001.
8. **TCXO ADJ control:** Same as 5, above. Refer to Paragraph 5-13, in Section V for information on Option 011 time base adjustment.

Figure 3-2b. Rear Panel Operating Controls and Indicators (Continued)

